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Appl. Ser. No.: 09/841,490
Atty. Dckt. No.: 5659-01100

In the Claims:

1017-1057 5396

Please cancel claims 1017-1057 and 5396 without prejudice.

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Amended claims 1058-1059, 1064-1066, 1069, 1074-1076, 1085, 1088, and 1091-1093 and new claims 5398-5439 are listed below. A marked-up copy of the amended claims is provided in an accompanying document.

1058. (amended) A method of treating a hydrocarbon containing formation in situ, comprising: providing heat from one or more heat sources to at least a portion of the formation; allowing the heat to transfer from the one or more heat sources to a pyrolysis zone of the formation;

controlling a pressure within the formation to inhibit production of hydrocarbons from the formation having carbon numbers greater than 25; and

producing a mixture from the formation.

1059. (amended) The method of claim 1058, wherein the one or more heat sources comprise at least two heat sources, and wherein superposition of heat from at least the two heat sources pyrolyzes at least some hydrocarbons within the pyrolysis zone of the formation.

1064. (amended) The method of claim 1058, further comprising controlling a temperature within at least a majority of the pyrolysis zone of the formation, wherein the pressure is controlled as a function of temperature, or the temperature is controlled as a function of pressure.

1065. (amended) The method of claim 1064, wherein controlling the temperature comprises maintaining a temperature within the pyrolysis zone within a pyrolysis temperature range.

1066. (amended) The method of claim 1058, further comprising controlling a heating rate such that an average heating rate of the pyrolysis zone is less than about 1 °C per day during pyrolysis.

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1069. (amended) The method of claim 1058, wherein providing heat from the one or more heat sources comprises heating the selected formation such that a thermal conductivity of at least a portion of the pyrolysis zone is greater than about 0.5 W/(m °C).

15 1074. (amended) The method of claim 1058, wherein the produced mixture comprises a non-aqueous portion, and wherein less than about 1 % by weight, when calculated on an atomic basis, of the non-aqueous portion is nitrogen.

16 1075. (amended) The method of claim 1058, wherein the produced mixture comprises a non-aqueous portion, and wherein less than about 1 % by weight, when calculated on an atomic basis, of the non-aqueous portion is oxygen.

17 1076. (amended) The method of claim 1058, wherein the produced mixture comprises a non-aqueous portion, and wherein less than about 1 % by weight, when calculated on an atomic basis, of the non-aqueous portion is sulfur.

Sub E 1085. (amended) The method of claim 1058, further comprising controlling the pressure within at least a majority of the pyrolysis zone of the formation, wherein the controlled pressure is at least about 2.0 bar absolute.

29 1088. (amended) The method of claim 1086, wherein controlling formation conditions comprises recirculating a portion of hydrogen from the mixture into the formation.

Sub E 1091. (amended) The method of claim 1058, wherein allowing the heat to transfer comprises increasing a permeability of a majority of the pyrolysis zone to greater than about 100 millidarcy.

27 1092. (amended) The method of claim 1058, wherein allowing the heat to transfer comprises substantially uniformly increasing a permeability of a majority of the pyrolysis zone.

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1093. (amended) The method of claim 1058, further comprising controlling a heating rate to yield greater than about 60 % by weight of condensable hydrocarbons, as measured by the Fischer Assay.

5398. (new) A method of treating a hydrocarbon containing formation in situ, comprising:
providing heat from one or more heat sources to at least a portion of the formation;
allowing the heat to transfer from the one or more heat sources to a selected section of the formation;
producing fluids from the formation; and
controlling a pressure within the formation such that the fluids produced have a weight ratio of hydrocarbons having carbon numbers in a range from 2-4 to methane of greater than approximately 0.3.

5399. (new) The method of claim 5398, wherein the one or more heat sources comprise at least two heat sources, and wherein superposition of heat from at least the two heat sources pyrolyzes at least some hydrocarbons within the selected section of the formation.

5400. (new) The method of claim 5398, wherein the one or more heat sources comprise natural distributed combustors.

5401. (new) The method of claim 5398, further comprising controlling a temperature within at least a majority of the selected section of the formation, wherein the pressure is controlled as a function of temperature, or the temperature is controlled as a function of pressure.

5402. (new) The method of claim 5401, wherein controlling the temperature comprises maintaining a temperature within a part of the selected section within a pyrolysis temperature range.

5403. (new) The method of claim 5398, further comprising controlling a heating rate such that an average heating rate of a part of the selected section is less than about 1 °C per day during pyrolysis.

5404. (new) The method of claim 5398, wherein allowing the heat to transfer comprises transferring heat substantially by conduction.

5405. (new) The method of claim 5398, wherein providing heat from the one or more heat sources comprises heating the selected formation such that a thermal conductivity of at least a part of the selected section is greater than about 0.5 W/(m °C).

5406. (new) The method of claim 5398, wherein the produced fluids comprise non-condensable hydrocarbons, and wherein about 0.1 % by weight to about 15 % by weight of the non-condensable hydrocarbons are olefins.

5407. (new) The method of claim 5398, wherein the produced fluids comprise non-condensable hydrocarbons, wherein a molar ratio of ethene to ethane in the non-condensable hydrocarbons is less than about 0.15, and wherein the ratio of ethene to ethane is greater than about 0.001.

5408. (new) The method of claim 5398, wherein the produced fluids comprise a non-condensable component, wherein the non-condensable component comprises hydrogen, wherein the hydrogen is greater than about 10 % by volume of the non-condensable component, and wherein the hydrogen is less than about 80 % by volume of the non-condensable component.

5409. (new) The method of claim 5398, wherein the produced fluids comprise ammonia, and wherein greater than about 0.05 % by weight of the fluids comprises ammonia.

5410. (new) The method of claim 5398, wherein the produced fluids comprise ammonia, and wherein the ammonia is used to produce fertilizer.

5411. (new) The method of claim 5398, further comprising controlling the pressure within at least a part of the selected section of the formation, wherein the controlled pressure is at least about 2.0 bars absolute.

5412. (new) The method of claim 5398, further comprising:
providing hydrogen (H₂) to the heated section to hydrogenate hydrocarbons within the section; and
heating a portion of the section with heat from hydrogenation.

5413. (new) The method of claim 5398, wherein allowing the heat to transfer comprises increasing a permeability of a part of the selected section to greater than about 100 millidarcy.

5414. (new) The method of claim 5398, wherein allowing the heat to transfer comprises substantially uniformly increasing a permeability of a part of the selected section.

5415. (new) The method of claim 5398, wherein producing the fluids comprises producing the fluids from a production well, and wherein at least about 7 heat sources are disposed in the formation for each production well.

5416. (new) The method of claim 5398, further comprising providing heat from three or more heat sources to at least a portion of the formation, wherein three or more of the heat sources are located in the formation in a unit of heat sources, and wherein the unit of heat sources comprises a triangular pattern.

5417. (new) The method of claim 5398, further comprising providing heat from three or more heat sources to at least a portion of the formation, wherein three or more of the heat sources are located in the formation in a unit of heat sources, wherein the unit of heat sources comprises a triangular pattern, and wherein a plurality of the units are repeated over an area of the formation to form a repetitive pattern of units.

5418. (new) The method of claim 5415, wherein at least about 20 heat sources are disposed in the formation for each production well.

5419. (new) A method of treating a hydrocarbon containing formation in situ, comprising:
providing heat from one or more heat sources to at least a portion of the formation;
allowing the heat to transfer from the one or more heat sources to a selected section of the formation;
producing fluids from the formation; and
controlling a pressure within the formation such that the fluids produced have a weight ratio of hydrocarbons having carbon numbers in a range from 2-4 to methane of greater than approximately 1.0.

5420. (new) The method of claim 5419, wherein the one or more heat sources comprise at least two heat sources, and wherein superposition of heat from at least the two heat sources pyrolyzes at least some hydrocarbons within the selected section of the formation.

5421. (new) The method of claim 5419, wherein the one or more heat sources comprise natural distributed combustors.

5422. (new) The method of claim 5419, further comprising controlling a temperature within at least a majority of the selected section of the formation, wherein the pressure is controlled as a function of temperature, or the temperature is controlled as a function of pressure.

5423. (new) The method of claim 5422, wherein controlling the temperature comprises maintaining a temperature within a part of the selected section within a pyrolysis temperature range.

5424. (new) The method of claim 5419, further comprising controlling a heating rate such that an average heating rate of a part of the selected section is less than about 1 °C per day during pyrolysis.

5425. (new) The method of claim 5419, wherein allowing the heat to transfer comprises transferring heat substantially by conduction.

5426. (new) The method of claim 5419, wherein providing heat from the one or more heat sources comprises heating the selected formation such that a thermal conductivity of at least a part of the selected section is greater than about 0.5 W/(m °C).

5427. (new) The method of claim 5419, wherein the produced fluids comprise non-condensable hydrocarbons, and wherein about 0.1 % by weight to about 15 % by weight of the non-condensable hydrocarbons are olefins.

5428. (new) The method of claim 5419, wherein the produced fluids comprise non-condensable hydrocarbons, wherein a molar ratio of ethene to ethane in the non-condensable hydrocarbons is less than about 0.15, and wherein the ratio of ethene to ethane is greater than about 0.001.

5429. (new) The method of claim 5419, wherein the produced fluids comprise a non-condensable component, wherein the non-condensable component comprises hydrogen, wherein the hydrogen is greater than about 10 % by volume of the non-condensable component, and wherein the hydrogen is less than about 80 % by volume of the non-condensable component.

5430. (new) The method of claim 5419, wherein the produced fluids comprise ammonia, and wherein greater than about 0.05 % by weight of the produced mixture is ammonia.

5431. (new) The method of claim 5419, wherein the produced fluids comprise ammonia, and wherein the ammonia is used to produce fertilizer.

5432. (new) The method of claim 5419, further comprising controlling the pressure within at least a majority of the selected section of the formation, wherein the controlled pressure is at least about 2.0 bars absolute.

5433. (new) The method of claim 5419, further comprising:
providing hydrogen (H₂) to the heated section to hydrogenate hydrocarbons within the section; and
heating a portion of the section with heat from hydrogenation.

5434. (new) The method of claim 5419, wherein allowing the heat to transfer comprises increasing a permeability of a majority of the selected section to greater than about 100 millidarcy.

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5435. (new) The method of claim 5419, wherein allowing the heat to transfer comprises substantially uniformly increasing a permeability of a majority of the selected section.

5436. (new) The method of claim 5419, wherein producing the fluids comprise producing the fluids from a production well, and wherein at least about 7 heat sources are disposed in the formation for each production well.

5437. (new) The method of claim 5419, further comprising providing heat from three or more heat sources to at least a portion of the formation, wherein three or more of the heat sources are located in the formation in a unit of heat sources, and wherein the unit of heat sources comprises a triangular pattern.

5438. (new) The method of claim 5419, further comprising providing heat from three or more heat sources to at least a portion of the formation, wherein three or more of the heat sources are located in the formation in a unit of heat sources, wherein the unit of heat sources comprises a

triangular pattern, and wherein a plurality of the units are repeated over an area of the formation to form a repetitive pattern of units.

Clo 5439. (new) The method of claim 5419, wherein at least about 20 heat sources are disposed in the formation for each production well.

Response To Office Action Mailed July 10, 2002

A. Pending Claims

Claims 1058-1096 and 5397-5439 are currently pending. Claims 1058-1059, 1064-1066, 1069, 1074-1076, 1085, 1088, and 1091-1093 have been amended. Claims 1017-1057 and 5396 have been cancelled without prejudice. Claims 5398-5439 are new.

B. Election/Restrictions

Applicant hereby elects the claims of Group II, namely claims 1058-1096 and 5397, drawn to a method of heating a hydrocarbon formation and inhibiting the production of hydrocarbons of carbon number greater than 25, without traverse. Applicant reserves the right to file divisional applications capturing the subject matter of the non-elected species.

C. Election of Species

In item 5 of the Office Action, the Examiner states: "Applicant is required under 35 U.S.C. 121 to elect a single disclosed species" of heater. Heaters are embodied in figures 10-17, 19, 24, 25, 26, and 28. Applicant elects the species of heater described at least in claim 1063. The generic name of the elected species is: "natural distributed combustor." Natural distributed combustors are illustrated at least in figures 10-15.



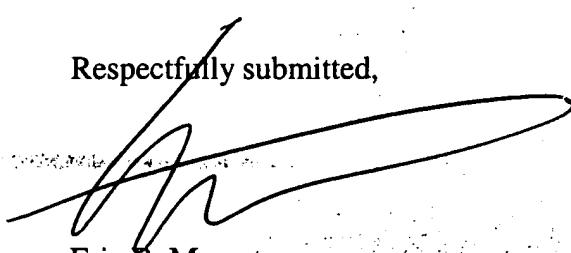
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Conclusion

Applicant believes that no fees are due in association with the filing of this document. If any extension of time is required, Applicant hereby requests the appropriate extension of time. If any fees are required, please charge those fees to Conley, Rose & Tayon, P.C. Deposit Account Number 50-1505/5659-01100/EBM.

Respectfully submitted,



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